

Space Weather Technical Forecast

Issued on Saturday 7 December 2024 at 01:06 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Low to Moderate solar activity. Slight chance G1/Minor Storm Day 3 (09 Dec).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Has been Moderate with an M1.2 flare peaking at 06/0920 UTC from AR3917. There are five active regions currently on the disc, however the majority of these are small and simple, and none have shown any significant development. AR3912 in the southwest is showing some minor magnetic complexity, but has a fairly simple structure, with a main leader spot and much smaller trailers. AR3916 in the southeast also appears to be comprised of a relatively small leader spot followed by simple trailers. AR3912 and AR3917 appear to be the most active regions on the disc, with AR3917 potentially having a beta-gamma configuration, as well as AR3912.

No Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as recorded at L1 by ACE, declined from slightly elevated to background levels, with wind speeds initially around 430 km/s, then near 380 km/s by the end of the period. Density was initially below average but then steadily increased to reach average levels. Total Interplanetary Magnetic Field (IMF), Bt, was weak at 7nT or below, while the north-south component varied weakly between +/- 5nT. Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels. The associated 24-hour fluence was below Active. The 07/0000UTC observation was 1.89e6 integrated pfu.

Four-Day Space Weather Forecast Summary

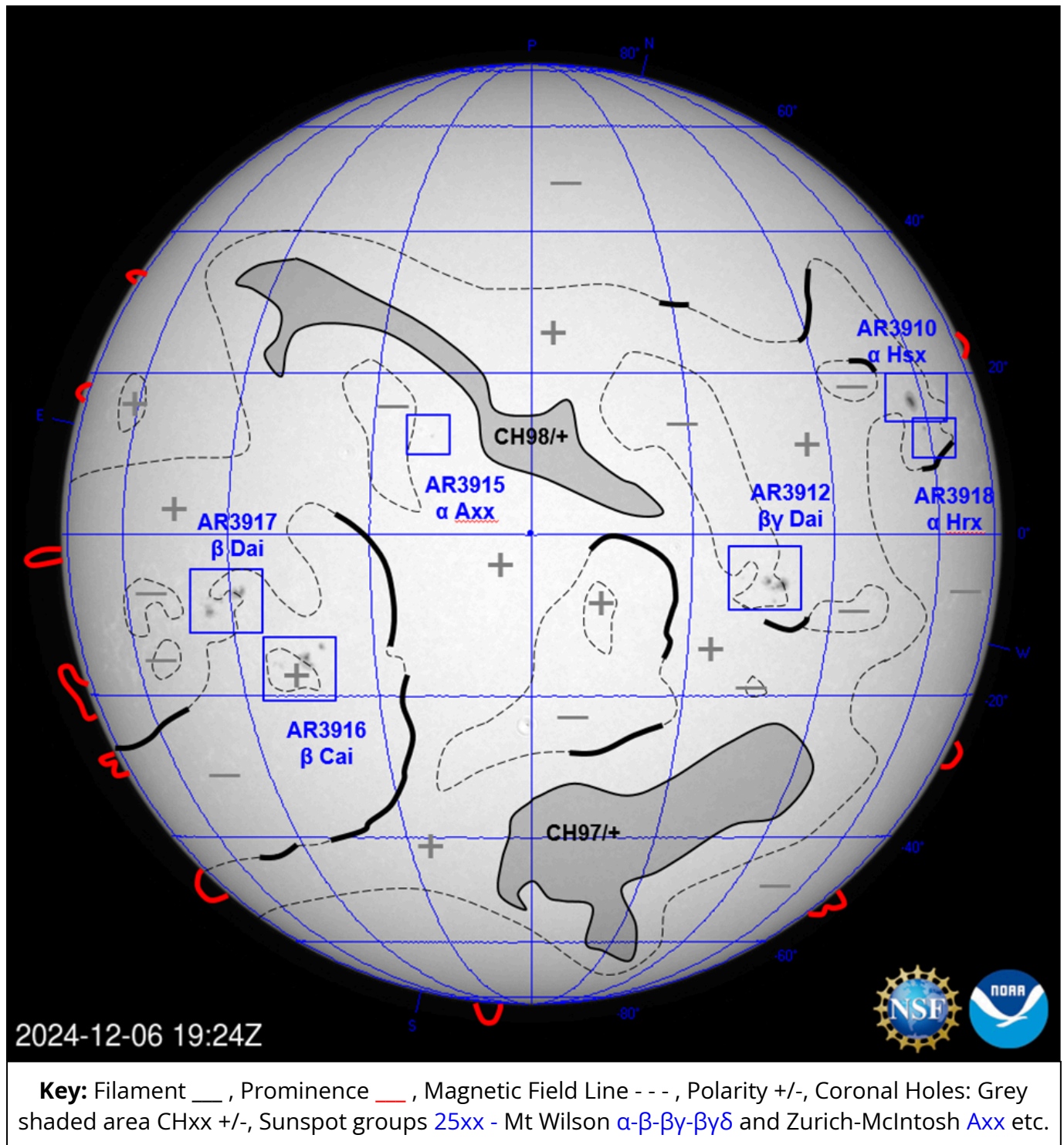
Solar Activity: Low to Moderate activity is expected with a chance of isolated M-flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently expected. Background or perhaps occasionally slightly elevated solar wind speeds are likely to continue until an expected connection to the fast wind from CH98/+ late on Day 3 (09 Dec), or perhaps into Day 4 (10th). Wind speeds of 450-500 km/s are probable.

Overall mainly Quiet conditions at first, which may increase to Unsettled to Active with a slight chance of G1/Minor Storm (Kp 5) intervals by the end of Day 3 (09 Dec) or early Day 4 (10th).

Energetic Particles / Solar Radiation: High energy protons are expected to persist at background levels. High energy electron flux is also expected to persist at background levels, with the associated 24 hour fluence remaining below the Active threshold.

Figure 1: Synoptic Map valid 06/1924 UTC



Geomagnetic Storms

There are no Earth-directed CMEs currently expected.

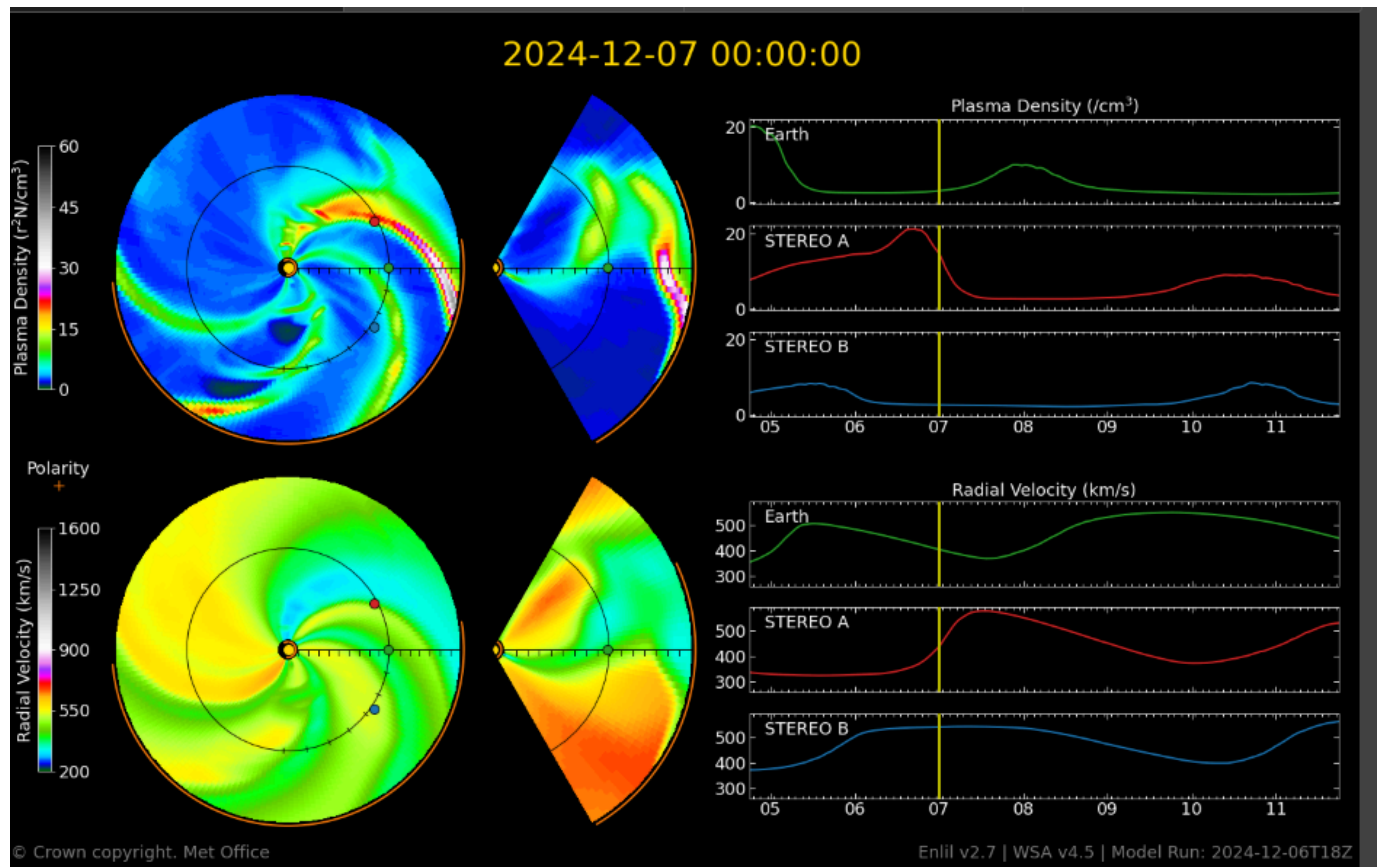
MOSWOC Enlil has recently had a weak connection to persistent CH97/+, but most of the HSS associated with CH97 has apparently gone to the south of Earth. This is supported by the previous rotation where wind speeds only reached just above 400 km/s, despite the coronal hole being located further north that time round. Background or perhaps occasionally slightly elevated solar wind speeds are likely to continue today or tomorrow.

A connection to the fast wind from CH98/+ is expected, most likely on Day 3 (09 Dec), or perhaps early Day 4 (10th). The latest MOSWOC Enlil now suggests a connection to this feature on 08 Dec, which is an improvement on previous runs which were bringing it in much too soon. This feature was present on the previous rotation, with the leading edge slightly further back than this time around, suggesting a faster onset than previously. However, wind speeds only reached just over 450 km/s last time so similar speeds of 450-500 km/s are likely. Confidence remains low for any notable geomagnetic activity however, as this is less favoured towards the solstices (Russell-McPherron effect).

Overall mainly Quiet conditions at first, which may increase to Unsettled to Active with a slight chance of G1/Minor Storm intervals by the end of Day 3 (09 Dec) and also early on Day 4 (10th).

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	10	10
Strong	G3	No	1	1	1	0
Severe	G4	No	1	1	1	0
Extreme	G5	No	1	1	1	0

Figure 2: MOSWOC ENLIL



Radio Blackouts - X-Ray Flares

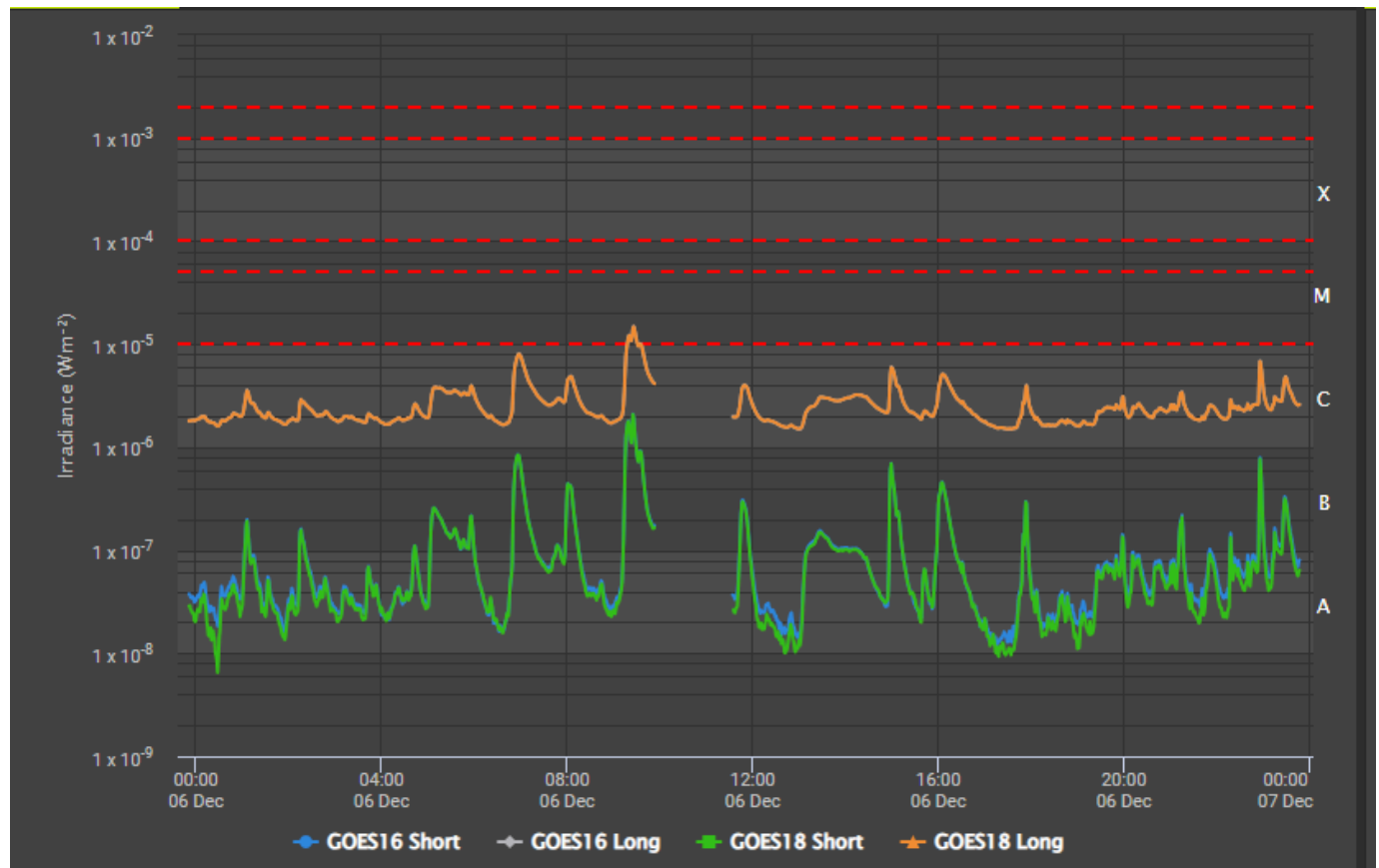
There are five active regions currently on the disc, with three previous regions fading from sight. The majority of the regions are small and simple, and none have shown any significant development. AR3912 in the southwest is showing some minor magnetic complexity, with a Dai/beta-gamma classification, but has a fairly simple structure, with a leader spot and much smaller trailers. AR3916 in the southeast also appears to be comprised of a relatively small leader spot followed by simple trailers. AR3912 and AR3917 have been the most active regions on the visible disc, with AR3917 potentially a beta-gamma as well as AR3912.

Far-sided products have no strong signals for returning groups from over the east limb, despite the potential for AR3904 and AR3898 to soon move back onto the disc. These may be related to some magnetic looping evident just over the southeast limb in GOES SUVI 195, while a further cluster of loops is evident in the northeast. Both these areas could be sources of oncoming activity.

Low to Moderate activity is expected to continue with an ongoing chance of M-flares and just a very slight chance of X-flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	40	40	40	40
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: GOES X-Ray flux from the past 24 hours.



Solar Radiation Storms (High Energy Protons)

GOES18 proton flux is currently at background levels and is expected to remain at this level with the sunspot regions on the Earth-facing disc currently small and relatively simple.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = cm ⁻² sr ⁻¹ s ⁻¹)						

High Energy Electrons ($\geq 2\text{MeV}$)

High energy Electron flux observed by GOES16 has been predominantly at background levels. This is expected to persist for the majority of the forecast period, with no significant coronal hole or CME enhancements currently anticipated. However, the expected connection to the HSS may lead to the electron flux increasing slightly to Moderate levels through Day 4 (10th).

The associated 24-hour fluence is expected to persist below Active levels, although with potentially a slight increase later on Day 4 (10th). The more significant increase in the fluence as indicated by MOSWOC REFM considered too early and overdone. However, overall the REFM is considered reasonable guidance, keeping the fluence below the Active threshold.

GEO Electron Environment	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2\text{ MeV}$ $\geq 1\times10^8$	No	1	1	1	10
Very Active	$\geq 2\text{ MeV}$ $\geq 1\times10^9$	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model.